as *Mariscus sumatrensis* and *Kyllinga hyalina.* These two taxa have been reported from Maharashtra, Karnataka and Tamil Nadu states by earlier workers. The present report from Andhra Pradesh is, therefore, a range extension.

Intensive ecofloristic surveys were conducted in the ponds, ditches, canals, streams and waterlogged areas in the state, to collect specimens. For taxonomic study, herbarium specimens were prepared using standard methods. Collections were made to understand the influence of climatic factors on certain key characters of the taxa. The specimens were deposited in Sri Krishnadevaraya University Herbarium (SKU), Anantapur.

Mariscus sumatrensis (Retz.) Raynal

Mariscus sumatrensis (Retz.) Raynal, Adansonia 15:110. 1975; T. Koyama, Gard. Bull. Singapore 30:154. 1977. *Kyllinga sumatrensis* Retz., Obs. Bot. 4:13. 1786. type sumatra wennerberg. *Mariscus sieberianus* Nees (Linnaea 9:286. 1835, *nom. nud.*) ex. Clarke in Hook. f , Fl. Brit. India. 6:122. 1893. Fig. 1.

Annual herbs. Culms up to 80 cm tall. Leaves shorter than culms, herbaceous; bracts 3-10. Inflorescence open, simple, rays 3-15. Spikes cylindrical, spikelets linear to linear-lanceolate. Glumes lanceolate-oblong to ovate oblong. Nuts linear-oblong, straw coloured.

Remarks: Rare in marshy areas along the streams.

Fl. & Fr.: August-November.

Distribution: EXTRALIMITAL: Tropical Old World, Introduced in the West Indies, Bangladesh, Sri Lanka, Nepal. INDIA: Andhra Pradesh (Cuddapah district, restricted to Lankamala waterfalls), Assam, Himachal Pradesh, Karnataka, Maharashtra, Sikkim.

Specimens examined: Near Lankamala waterfalls, (CDP), MHR & KI 14904.

Kyllinga hyalina (Vahl) T. Koyama

Kyllinga hyalina (Vahl) T. Koyama, J. Jap. Bot. 51 (10): 313. 1976. *Cyperus hyalinus* Vahl Enum. Pl. 2:239. 1806. *Pycreus pumilus* Clarke in Hook. f., Fl. Brit. India. 6:591. 1893; Fischer 1625 (1130).

Annual herbs. Culms 6-20 cm tall. Leaves shorter than, to slightly overtopping, the culms, thinly herbaceous; bracts 3-6. Inflorescence open and lax, umbelliform with elongated rays, rays 2-6. Spikelets ovate to elliptic. Glumes ovate. Nuts elliptic to broadly elliptic, brown.

Remarks: Sporadically occurring in open forests, especially during rainy season.

Fl. & Fr.: August-November.

Distribution: EXTRALIMITAL: Tropical East Africa, Massacres Is., Indochina, Malesia and Northern Australia.

INDIA: Andhra Pradesh (Cuddapah), Karnataka, Maharashtra, Tamil Nadu.

Specimens examined: Lankamalleswaram east (CDP), SRS & KI 13152.

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38. FOOD VALUE OF SOME EDIBLE FERNS FROM DHARAN, SOUTHEASTERN NEPAL

Within the next three decades, the world will have to double its food production to meet the demand of its increasing population (Myers 1999) and meet the health requirements of

human beings. This is a real challenge. Recent technological advances (Leisinger 1999) and exploitation of unknown or neglected food resources from nature may solve this problem. Nature has endowed us with abundant plant resources. In comparison to the plethora of flora at our disposal, the numbers that have been exploited directly to fulfil human requirements is comparatively small. Ferns and their allies are but a few of them. Some ferns have always been used for culinary purposes, the demand being fulfilled from wild sources. A generic term used in Nepal for all the edible ferns is '*niuro*' or '*niguro*' (Gurung 1984).

Ferns and their allies are among the green vegetables available in the vicinity of Dharan, mainly in the monsoon. Their most common use is as green vegetables. Tender varieties in particular are pickled and sometimes fermented for "*gundruk*", a preparation leafy vegetable indigenous to Nepal (Karki 1986). Less often, edible fern is sun dried and preserved. In some parts of the country, succulent parts of the plant are simply crushed or squashed and eaten, probably to quench summer thirst.

Vegetables are used for organoleptic reasons. That they also contribute significantly towards a balanced nutrition through synergistic interactions among food components, unfortunately, very often goes unnoticed. Although much work has not been done on edible ferns, they could be as valuable as any conventional vegetable (Anon. 1982). The present work attempts to estimate the nutrient contents of some edible ferns growing naturally in and around Dharan, Nepal.

'*Niguros*' are generally available from June to September. All the samples were collected when the plants were tender, from forest areas in and around Dharan. Edibility of the ferns was confirmed from local collectors and vegetable markets of Dharan, where they are often displayed for sale. Identity of plants was confirmed from the National Herbarium and Plant Laboratory, Godavari, Kathmandu, Nepal. The freshly collected samples (about 1 kg each) were carefully packed in polythene bags and sent to the laboratory for chemical analysis.

The plants were prepared and parts unsuitable for culinary purposes were removed, to obtain data as relevant as possible to kitchen protocol. Soil and dirt were meticulously removed. Representative samples were taken for determining moisture, while the remaining were finely shredded and dried in a hot air oven at 110 °C (Rangana 1986). Dried samples were powdered in a mortar, dried once again at 110 °C, packed hot in clean, screwtop glass containers, and reserved in a desiccator. All subsequent analyses were carried out using the reserved powders, which were thoroughly dried using IR radiation before weighing them for analyses.

TABLE 1

PROXIMATE COMPOSITION OF VARIOUS FERNS AND FERN ALLIES FROM DHARAN, NEPAL (PER 100 G EDIBLE PORTION)

Item	Moisture (g)	Carbohydrate (g)	Crude protein (g)	Crude fat (g)	Total ash (g)
Diplazium esculentum Swartz	90.10	4.9	3.4	0.2	1.4
D. maximum (D.Don.) C. Chr.	91.36	4.452	3.01	0.108	1.07
Ophioglossum vulgatum Linn.	92.21	3.356	2.47	1.00	0.964
Sterochlaena palustris (Burm.) Bedd.	91.17	4.982	2.99	0.07	0.778
Tectaria macrodonta (Fee) C. Chr.	91.48	4.186	2.90	0.295	1.139

TABLE 2
ASH COMPONENTS OF VARIOUS FERNS AND FERN ALLIES FROM DHARAN, NEPAL
(PER 100 G EDIBLE PORTION)

Item	Ash		Calcium (mg)	Iron (mg)
	Acid-insoluble (g)	Acid-soluble (g)		
Diplazium esculentum Swartz	-	-	-	2.77
D. maximum (D. Don.) C. Chr.	0.0649	1.005	17.24	0.84
Ophioglossum vulgatum Linn.	0.0647	0.899	36.31	7.01
Sterochlaena palustris (Burm.) Bedd.	0.0857	0.702	9.59	0.92
Tectaria macrodonta (Fee) C. Chr.	0.0735	1.066	16.63	4.95

Particulars of the parameters and the assessment methods used were as under:

Parameter	**Method**
Crude Protein	Rangana 1986; Kjeldahl method
Crude fat	Pearson 1976; Solvent extraction
Ash (Total and acid-insoluble)	Rangana 1986
Moisture	Rangana, 1986; IR method
Carbohydrate	Horwitz 1980; By difference
Iron	Rangana 1986; Colorimetric method
Calcium	Horwitz 1980; AOAC method, titrimetric

Proximate analysis of the collected samples showed favourable comparison with other conventional vegetables. The results of proximate analysis and various ash components of the samples are presented in Tables 1 and 2, whereas Table 3 is a compilation from earlier publications. Mudambi and Rajagopal (1990) had analysed a number of leafy vegetables, the composition of which is given in Table 3.

Comparison of Tables 1, 2 and 3 shows that the food values of the above five species of pteridophytes average those of conventional vegetables. In general, *Ophioglossum vulgatum* and *Tectaria macrodonta* are the prized ones. They excel other varieties not only in terms of quality, but also in organoleptic values. Besides, they have curiosity value and so they sell more. Moreover, the amino acid profile of ferns is reported to be similar to spermatophytes in terms of type and abundance, the sequence in decreasing order being arginine, lysine, tyrosine, methionine, tryptophan and cysteine (Meyer, 1960).

However, nutritional value notwithstanding, these wild vegetables cannot be expected to contribute much to our dietary

TABLE 3
PROXIMATE COMPOSITION OF '*NIGURO*' AND CONVENTIONAL LEAFY VEGETABLES
(PER 100 G EDIBLE PORTION)

	Protein (g)	Fat (g)	Carbohy drate (g)	Moisture (g)	Crude Fibre (g)	Minerals (g)	Calcium (mg)	Vit.C (mg)
Green leafy vegetables*	1.8-4.4	0.1-1.7	1.4-12.5	75.9-95.2	-	0.6-2.7	-	-
*Niguro***	4.4	0.2	4.2	88	1.8	1.3	30	4.8

Sources; * Mudambi and Rajagopal (1990)

** Anonymous (1986)

requirements unless mass cultivated, and no such efforts seem to have ever been made. What comes to the market is directly from the wild, and this trend is likely to continue, unless further research to cultivate and exploit them is conducted.

The present work is still fragmentary. The data obtained by chemical analysis is not necessarily relevant to intricate biological systems of nutrition and absorption. But emphasis must be placed on bio-availability. For instance, protein must be further assayed to determine the digestibility and indispensable amino acid profile. Minerals are available only in the absence of interfering entities such as oxalates and phylates. Vitamin profile, crude fibre content and toxic principle(s), if any, are other important aspects that must be thoroughly researched before popularising wild plants for edible purposes.

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REFERENCES

ANON. (1982): Wild edible plants of Nepal. *Bull. Dept. Med. Pl. Nepal 9*: 105-259.

GURUNG, V.L. (1984): Ferns. *In*: Nepal: Nature's Paradise. (Ed.: Majupuria, T.C.), Craftsman Press, Bangkok. Pp. 194-211.

HORWITZ, W. (Ed.) (1980): Official Method of Analysis of the Association of Official Analytical Chemists. (13th edn.), AOAC, Washington, DC.

KARKI, T.B. (1986): Gundruk. *In*: A Concise Book of Indigenous Fermented Foods in the ASCA Countries. (Ed.: Saono, S.), The Govt. of Australia, Canberra, Australia. Pp. 67.

LEISINGER, K.M. (1999): Biotechnology and food security. *Curr. Sci 76*: 488-500.

MEYER, L.H. (1960): Food Chemistry. CBS Publishers and Distributors. Pp. 139.

MUDAMBI, S.R. & M.V. RAJAGOPAL (1990): Fundamentals of Foods and Nutrition. 3rd edn. Wiley Eastern Ltd. Pp. 228.

MYERS, N. (1999): The next green revolution: Its environmental underpinnings. *Curr. Sci. 76*: 507-513.

PEARSON, D. (1976): The Chemical Analysis of Foods. 7th ed. Churchill Livingstone. Pp 14.

RANGANA, S. (1986): Handbook of Analysis and Quality Control for Fruit and Vegetable Products. 2nd edn. Tata McGraw Hill. Pp 21-24, 126-127.

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ERRATA

Vol. 98(2), p. 288. The 2nd author Yogesh Srivastawa was inadvertently printed as Yogesh Sharma. The error is regretted.